

# Population Aging and the Three Demographic Dividends in Asia

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The present study first examines the trends in age structural shifts in selected Asian economies over the period 1950–2050 and analyzes their impact on economic growth in terms of the first and second demographic dividends computed from the system of National Transfer Accounts. Then, using the National Transfer Accounts, we analyze the effect of the age structural shifts on the pattern of intergenerational transfers in Japan; the Republic of Korea; and Taipei, China. A brief comparison of the results reveals that, in the next few decades, the latter two are likely to follow in Japan's footsteps by increasing public transfers and asset reallocations, and by reducing familial transfers, particularly among older persons. Next, we consider a newly defined demographic dividend, which is generated through the use of the untapped work capacity of healthy older persons and to which we refer as “the silver” or “the third” demographic dividend. By drawing upon microlevel datasets obtained from Japan and Malaysia, we calculate the magnitude of the impact of that dividend on macroeconomic growth in each of the two economies, concluding that while in Japan the expected effect is substantial, in Malaysia it will take several decades before the country can enjoy comparable benefits.

*Keywords:* demographic dividends, intergenerational transfers, National Transfer Accounts, population aging

*JEL codes:* J11, J14

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## I. Introduction

In the 20th century, the world population growth rate peaked in the latter half of the 1960s. Since then, the tempo of growth has been continuously slowing

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down, owing to substantial fertility declines in a host of developed economies and a growing number of developing economies. As a result, in the past few decades, population aging has been observed on a worldwide basis.

In various parts of the world, population aging has been accompanied by the rapid growth of elderly populations. In 2015, elderly persons aged 65 and over in Asia accounted for 55% of the elderly population of the world as a whole, and this proportion is projected to increase to more than 60% by 2050 (United Nations [UN] 2017). Moreover, the number of those aged 65 and over grew dramatically at 2.4% per annum in the second half of the 20th century. The corresponding number for the first half of the 21st century is even projected to increase to 2.6%. Furthermore, in Asia the proportion of the elderly in the total population rose from 4% to 5.8% over the period 1950–2000, and is expected to grow at an astonishing tempo in the years to come and reach 17.8% by the middle of the 21st century (UN 2017).

In marked contrast, the proportion of Asia's young persons aged 0–14 is projected to continuously decline from its peak value of 41% in 1965 to 18% in 2050. Although the actual number of young people more than doubled in the latter half of the 20th century, it is now expected to decrease—from 1.13 billion in 2000 to 0.95 billion in 2050—at an annual rate of 0.4%.

As far as Asia's working-age population (those aged 15–64) is concerned, it is expected to expand more than 4 times from 1950 to 2050, while its proportion in the total population is anticipated to fluctuate between 56% and 68% over the same period. However, the age composition of the productive population is projected to undergo a substantial transformation over the period in question. During the period 1950–1990, for example, the proportion of those aged 15–24 in Asia's total population oscillated between 17% and 20%. After having recorded a peak of 20% in 1990, the proportion has been and will continue to be on a downward trend, diminishing to 13% by 2050.

More importantly, within Asia, there have been considerable intereconomy differences in the level and speed of population aging (Fu and Hughes 2009; Park, Lee, and Mason 2012). In a number of Asian economies, unprecedented changes in age structure have occurred or are under way. In some of these economies, the rise in old-age dependency has created myriad formidable policy challenges, the response to which is likely to seriously influence their economic growth, poverty, intergenerational equity, and social welfare for decades to come. In other economies of Asia, the child dependency ratio has been falling rapidly, generating an important demographic bonus, and facilitating faster economic growth.

To analyze the impact of age structural shifts on numerous socioeconomic aspects, conventional demographic indicators such as the total dependency ratio are commonly employed (Komine and Kabe 2009, Cheung et al. 2004, Golini 2004). These widely used indicators are exclusively based on chronological age distributions in which each individual is equally counted as one regardless of age.

From an economic point of view, however, the level of production and the amount of consumption vary with age, so weights adjusted by age-specific per capita income and consumption need to be assigned to each age group. Taking into account this important point, the present study draws heavily upon a newly developed, comprehensive, analytical framework called the National Transfer Accounts (NTA) for estimating consumption, production, and resource reallocations by age on a per capita basis.

In section II of this paper, we review patterns of age compositional shifts in Asia since 1950. In section III, we examine the impact of age compositional shifts on economic growth using two approaches: (i) conventional demographic indicators and (ii) the NTA framework. In the first approach, the economic benefit of the youth bulge induced by fertility declines is called “the demographic bonus,” while in the second it is referred to as “the first demographic dividend.” In section IV, we use the NTA model to analyze a key economic challenge for aging populations, which is how to provide for old-age consumption in the face of substantially reduced income. In some societies, this challenge is met by relying on intergenerational transfer systems (either public programs or familial support systems). In others, the response consists of increasing saving rates and accumulating greater physical wealth or capital. It is in this latter response that prospects for more rapid economic growth are enhanced, and this pro-growth mechanism is called “the second demographic dividend.” Furthermore, we continuously employ the NTA framework to shed light on how intergenerational transfer patterns change in the process of age structural transformations. In section V, we turn our attention from the system of NTA to an analysis of a newly defined demographic dividend, which is generated through the use of the untapped work capacity of healthy older persons. In the present study, this newly measured demographic dividend is labelled as “the silver demographic dividend.” We might as well call it “the third demographic dividend” to distinguish it from the two demographic dividends directly computed from the NTA system.

This paper contains the following: (i) a brief review of Asia’s changing demographic landscape, with emphasis on age structural transformations among selected Asian economies; (ii) a succinct description of the NTA model to facilitate the analysis that follows in the remainder of the paper; (iii) an in-depth discussion of the demographic transition and its relationship to the first and second demographic dividends, utilizing the cross-sectional results for 12 selected Asian economies computed from the NTA system; (iv) a comparative analysis of changing intergenerational transfer patterns in three rapidly aging East Asian economies (Japan; the Republic of Korea; and Taipei, China); and (v) a quantitative measurement of the potential work capacity among older workers (i.e., “the silver demographic dividend” or “the third demographic dividend”) based on microlevel data analyses for Japan and Malaysia. The final section of the paper summarizes the major findings of the study.

## II. Rapidly Changing Age Compositional Shifts in Asia: 1950–2050

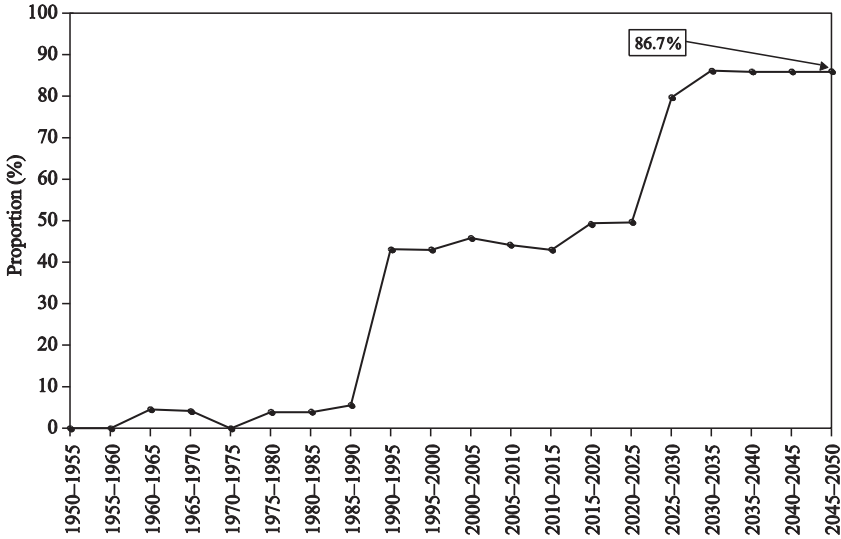
In 2015, Asia's total population exceeded 4.4 billion people, which is approximately 2.3 times larger than the population observed in 1965 (UN 2017). The annual growth rate of the population in Asia, however, has declined continuously during the past 4 decades. After peaking at 2.45% from 1965 to 1970, the region's annual population growth rate during the 2010s is estimated at 0.98%. With the emergence of slower population growth in the latter half of the 20th century, Asia's demographic outlook today is substantially different from that of only a few decades ago.

Such substantially slower population growth in Asia has been caused chiefly by a significant decline in fertility over the past few decades. From 1965 to 1970, there was only one economy in Asia, Japan, with below-replacement fertility (i.e., a total fertility rate [TFR] of less than 2.1 children per woman). Japan's postwar fertility decline was the first of its kind to occur in the non-Western world, and it was the greatest in magnitude among all industrialized economies (Ogawa, Jones, and Williamson 1993; Hodge and Ogawa 1991). Following a short-lived baby boom period (1947–1949), Japan's fertility dropped dramatically (Ogawa and Retherford 1993; Retherford and Ogawa 2006; Ogawa, Retherford, and Matsukura 2009). Between 1947 and 1957, Japan's TFR declined by more than 50% from 4.54 to 2.04 children per woman. This reduction of fertility over a 10-year period was the first such experience in the history of humankind. Subsequent to it, there had been only minor fluctuations around the replacement level until the first oil crisis occurred in 1973. Thereafter, the TFR started to fall again and reached 1.26 in 2005, which was an all-time low in postwar Japan. Since 2005, however, Japan's TFR has been on an upward trend, reaching 1.43 in 2017. If fertility were to remain constant at this level, the population of each successive generation would decline approximately at a rate of 31% per generation.<sup>1</sup>

Moreover, in terms of the population share, as shown in Figure 1, only 5.4% of Asia's population lived in economies with below-replacement fertility in 1960–1965, compared with 43.9% in 1990–1995, when the People's Republic of China's (PRC) fertility rate fell below the replacement level. In the second half of the 2010s, slightly more than a half of Asia's population resided in societies with below-replacement fertility, and more than 80% of the Asian population will live in economies with a fertility rate below the replacement level in the late 2020s, when India is projected to reach a below-replacement level of fertility (UN 2017). At present, among the economies of the three Asian subregions defined in the 2017 UN population projection (East Asia, Southeast Asia, and South Asia), there are two economies with below-replacement fertility (Singapore and Taipei, China) that

<sup>1</sup>As of 2017, Japan's replacement fertility level was 2.07. Thus,  $1.43/2.07 = 0.69$ , which implies that if Japan's TFR remains unchanged in the years to come, the size of each successive generation will diminish by 31%.

Figure 1. **Proportion of the Asian Population Living in Economies with Below-Replacement-Level Fertility, 1950–2050**



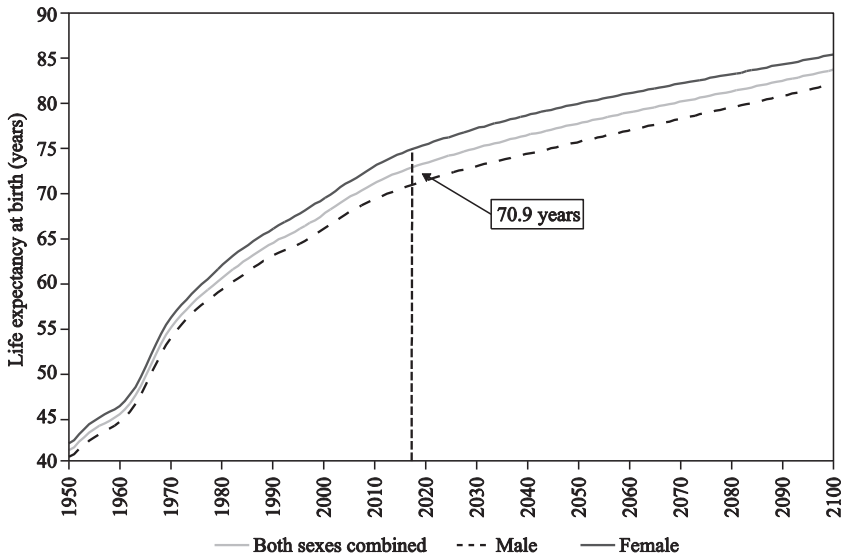
Source: Authors' calculations based on data from United Nations. 2017. *World Population Prospects: The 2017 Revision*. New York.

are classified in the category of lowest-low fertility (i.e., those with a TFR below 1.3).<sup>2</sup> In fact, East Asia's fertility has been the lowest in the entire world since the 1990s (Gubhaju 2008; Ogawa et al. 2009; McDonald 2009; Gauthier 2015; Ogawa, Matsukura, and Lee 2016).

Parallel to the rapid decline in fertility, marked mortality improvements have occurred in Asia. The Japanese postwar experience is particularly a case in point. When Japan joined the Organisation for Economic Co-operation and Development in 1964, its life expectancy at birth was lower than that of any other member country, but its life expectancy became the highest among all member states by the early 1980s (Mason and Ogawa 2001). In 2017, Japan's male life expectancy at birth reached 81.1 years to become the third highest in the world, following Switzerland and Hong Kong, China, while its female life expectancy reached 87.3 years, the second highest in the world, following only Hong Kong, China. Moreover, 18 economies and areas in the three abovementioned Asian subregions have life expectancies higher than 70 years for both sexes combined. As indicated in Figure 2, the value of life expectancy at birth for both sexes combined for Asia as a whole during 2015–2020 was 70.9 years, and it is generally considered that mortality

<sup>2</sup>According to the 2017 UN population projection, the Republic of Korea's projected TFR for 2018 was 1.33, but the country's actual TFR for that year was just 0.98. Based on its actual TFR, the Republic of Korea should be classified in the category of lowest-low fertility.

Figure 2. Life Expectancy at Birth for Asia as a Whole, 1950–2100



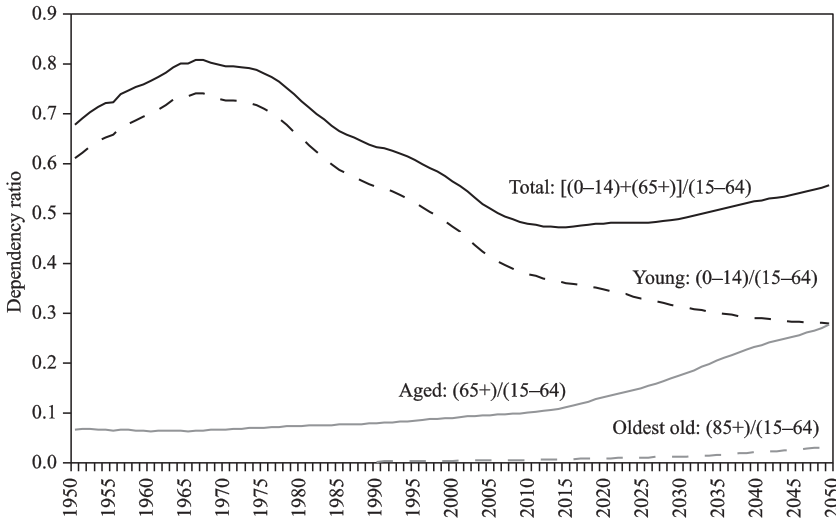
Source: Authors' calculations based on data from United Nations. 2017. *World Population Prospects: The 2017 Revision*. New York.

improvements begin to contribute to advancing the process of population aging once the level of life expectancy at birth exceeds 70 years (Myers 1988).<sup>3</sup>

As a result of these rapid fertility and mortality transformations in the latter half of the 20th century, we have witnessed phenomenal changes in Asia's demographic landscape in terms of population age compositions, with a relative increase in the numbers of older persons and a relative decrease in the numbers of the young. As illustrated in Figure 3, Asia's total dependency ratio, which is defined as  $[(0-14) + (65 \text{ and over})]/(15-64)$ , reached its peak value (0.80) in 1965, after which its long-term trend shows a U-shaped pattern, reaching its trough value (0.47) in 2015. This implies that in Asia as a whole, the share of the working-age population increased from 1965 to the middle of the 2010s. For Asia, these 50 years during which the share of the working-age population continuously rose corresponded to the period in which age structural shifts contributed to a favorable impact on the per capita income growth, a phenomenon called "the first demographic dividend," which is exemplified by the "economic miracle" of East Asian economies between 1960 and 1997 (Bloom and Williamson 1998, Mason 2001). A detailed analysis of the first demographic dividend in Asia will be presented in the ensuing section.

<sup>3</sup>At an early stage of mortality improvements, the extension of life is induced mainly by the reduction of infant and child mortality, rather than by better survivorship at older ages. Hence, at the initial stage of mortality transition, rising life expectancy leads to population rejuvenation rather than population aging (Ogawa 1986).

Figure 3. Changes in Dependency Ratios for Asia as a Whole, 1950–2050



Source: Authors' calculations based on data from United Nations, 2017. *World Population Prospects: The 2017 Revision*. New York.

By and large, the demographic transition is a singular time period during which fertility and mortality decline from high to low levels in a particular economy. In the case of Asia, although the broad outlines of the demographic transition are fairly similar in almost every economy in the region, the speed and timing of the transition vary considerably across economies. The age composition of each of the Asian economies under review has been changing swiftly since the middle of the 20th century (Ogawa 2003). As shown in Table 1, from 1975 to 2000, the total dependency ratio declined substantially in all three subregions and in 15 out of the 17 economies listed (the Lao People's Democratic Republic [Lao PDR] and Nepal being the only exceptions). The extent to which the total dependency ratio for each economy decreased over this period is closely related to the magnitude with which its fertility declined, as reflected in the intertemporal change in the youth dependency ratio, defined as  $[(0-14)/(15-64)]$ . Among the 17 economies in Table 1, Thailand had the largest reduction in the total dependency ratio at 0.413 (from 0.852 to 0.439), followed by Mongolia (0.383), the Republic of Korea (0.337), the PRC (0.321), Indonesia (0.304), Viet Nam (0.291), Malaysia (0.242), Bangladesh (0.235), and the Islamic Republic of Iran (0.227). The fact that all of these economies have shown substantial economic progress over the past few decades seems to suggest that such steep declines in the total dependency ratio facilitated their recent rapid economic growth.

The 2017 UN population projection, as shown in Table 1, indicates that the economies with high total dependency ratios will face a considerable reduction

Table 1. Age Structural Changes for Selected Asian Countries in 1975, 2000, 2025, and 2050

Country	1975				2000				2025				2050			
	Dependency Ratio		Index of Aging		Dependency Ratio		Index of Aging		Dependency Ratio		Index of Aging		Dependency Ratio		Index of Aging	
	Total	Young Aged	Index of Aging	Index of Aging	Total	Young Aged	Index of Aging	Index of Aging	Total	Young Aged	Index of Aging	Index of Aging	Total	Young Aged	Index of Aging	
Asia	0.781	0.710	0.071	10	0.565	0.474	0.091	19	0.482	0.331	0.150	45	0.558	0.280	0.278	99
East Asia	0.740	0.663	0.077	12	0.458	0.345	0.114	33	0.465	0.238	0.227	96	0.698	0.235	0.463	197
PRC	0.782	0.709	0.073	10	0.461	0.360	0.101	28	0.445	0.241	0.205	85	0.674	0.234	0.440	188
Japan	0.473	0.359	0.113	32	0.466	0.217	0.249	115	0.715	0.213	0.502	235	0.958	0.246	0.712	290
Mongolia	1.008	0.910	0.098	11	0.625	0.565	0.060	11	0.536	0.453	0.084	19	0.539	0.343	0.196	57
Republic of Korea	0.722	0.657	0.065	10	0.385	0.286	0.099	35	0.490	0.194	0.296	152	0.880	0.217	0.663	305
Southeast Asia	0.863	0.794	0.069	9	0.580	0.502	0.078	15	0.483	0.360	0.123	34	0.538	0.299	0.239	80
Indonesia	0.852	0.788	0.064	8	0.548	0.475	0.073	15	0.469	0.367	0.102	28	0.507	0.300	0.207	69
Singapore	0.585	0.520	0.065	13	0.405	0.301	0.103	34	0.483	0.198	0.198	144	0.804	0.198	0.606	306
Thailand	0.852	0.786	0.066	8	0.439	0.345	0.094	27	0.449	0.217	0.232	107	0.724	0.224	0.500	223
Cambodia	0.877	0.828	0.049	6	0.807	0.752	0.056	7	0.535	0.450	0.085	19	0.514	0.330	0.184	59
Lao PDR	0.841	0.783	0.058	7	0.885	0.818	0.067	8	0.521	0.448	0.073	15	0.444	0.291	0.153	44
Malaysia	0.836	0.771	0.066	8	0.594	0.532	0.062	12	0.455	0.334	0.121	38	0.498	0.254	0.244	100
Philippines	0.908	0.849	0.060	7	0.716	0.661	0.056	8	0.556	0.464	0.092	20	0.508	0.360	0.148	41
Viet Nam	0.906	0.812	0.094	12	0.615	0.511	0.104	20	0.449	0.332	0.117	46	0.624	0.275	0.349	122
South Asia	0.798	0.736	0.062	8	0.668	0.596	0.072	12	0.488	0.383	0.105	27	0.486	0.289	0.197	68
Bangladesh	0.927	0.869	0.058	7	0.692	0.627	0.065	10	0.444	0.357	0.087	24	0.495	0.255	0.240	94
India	0.772	0.710	0.062	9	0.643	0.571	0.072	13	0.476	0.366	0.111	30	0.477	0.278	0.198	71
Pakistan	0.883	0.812	0.071	9	0.824	0.750	0.075	10	0.605	0.526	0.079	15	0.500	0.373	0.127	34
Nepal	0.786	0.730	0.056	8	0.810	0.742	0.068	9	0.486	0.387	0.099	25	0.428	0.248	0.180	72
Islamic Republic of Iran	0.870	0.810	0.059	7	0.643	0.574	0.069	12	0.409	0.298	0.111	37	0.609	0.239	0.370	148

Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Source: Authors' calculations based on data from United Nations. 2017. *World Population Prospects: The 2017 Revision*. New York.



of the burden placed upon the working-age population in the first quarter of the 21st century and beyond. In these economies, the declining total dependency ratios are likely to facilitate their developmental process. In contrast, the economies with low total dependency ratios are expected to undergo a substantial increase in this burden, mainly due to a rapid rise in the proportion of the elderly, as represented by the aged dependency ratio expressed as  $[(65+)/((15-64))]$ . In economies where the onset of fertility reduction was early, the changes in this aged dependency ratio are most pronounced. Clearly, Japan had the largest gain (+0.136) from 0.113 in 1975 to 0.249 in 2000. Singapore showed the second largest gain (+0.042) from 0.065 to 0.103 over the same period, followed by the Republic of Korea (+0.034), Thailand (+0.028), and the PRC (+0.028).

Among the 17 economies listed in Table 1, Japan is expected to have the highest aged dependency ratio continuously up to 2050. However, a careful comparison of the index of aging, which is defined as  $[(65 \text{ and over})/(0-14)] \times 100$ , yields a picture substantially different from the one based upon the aged dependency ratios. By 2000, Japan's index of aging had already exceeded 100. Over the period 2000–2025, Japan is expected to remain the most aged society not only in Asia but also in the entire world. By 2050, however, the values of the index of aging for Singapore and the Republic of Korea are projected to surpass that for Japan. In addition, for Asia as a whole, the index of aging is projected to nearly reach 100 in 2050, which is considerably earlier than in 2074, which is the year projected for the entire world, as depicted in Figure 4.<sup>4</sup> Throughout human history, children were substantially more numerous than the elderly, and the index of aging for the whole world has never surpassed the 100 level. In the recent past, this newly emerging demographic turning point has been called “the historic reversal of populations” (Chamie 2016).

The data reported in Table 1 cover only four selected points in time: 1975, 2000, 2025, and 2050. It can be easily conceived that the age composition of each economy undergoes a considerable transformation and transition. To shed light upon such dynamic aspects of age structural shifts and their impacts on economic growth, we turn our attention in the next section to the demographic dividends in a number of selected Asian economies using the NTA framework.

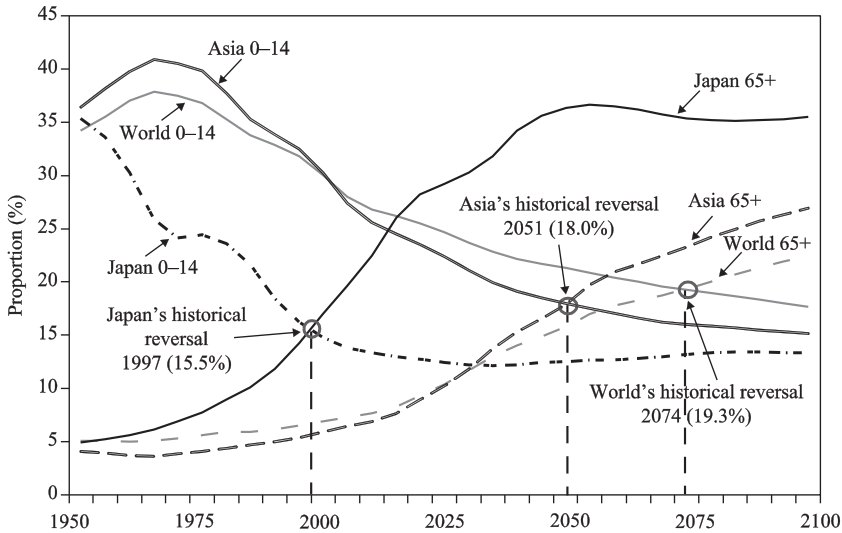
### III. The Impact of Age Structural Shifts on the First and Second Demographic Dividends

#### A. Measuring the Impact of Demographic Changes on Economic Growth

In the 1990s, some population economists began to use the term “demographic bonus.” However, since then a number of new terms referring to the

<sup>4</sup>The index of aging for the entire Asia is projected to exceed 100 in 2051.

Figure 4. **The Timing of the Historical Reversal of Populations: Japan, Asia, and the World**



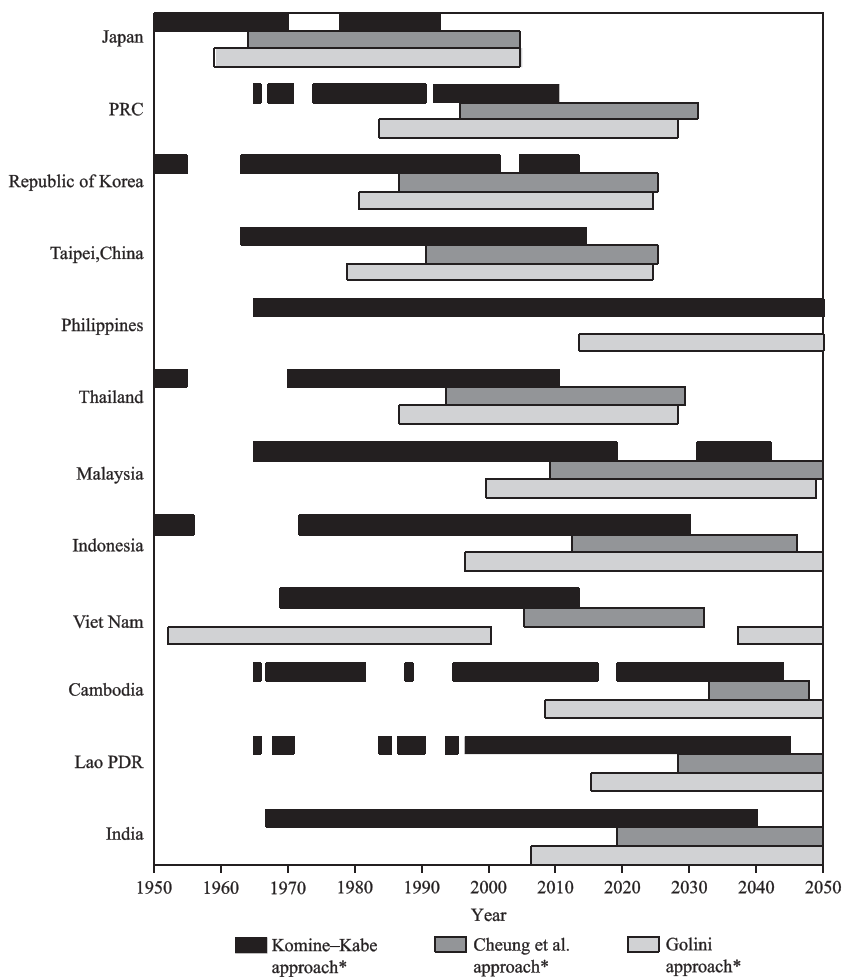
Source: Authors' calculations based on data from United Nations. 2017. *World Population Prospects: The 2017 Revision*. New York.

same, or a highly comparable demographic-economic nexus, has appeared, ranging broadly from such an expression as “demographic gift” to the term “window of opportunity.” It is often the case that the total dependency ratio is defined differently among researchers. Moreover, different criteria have been utilized to judge, on the basis of computed total dependency ratios, whether or not an economy is at the stage of a demographic bonus. For instance, Komine and Kabe (2009), who use the conventional total dependency ratio, regard an economy as being at the stage of a demographic bonus when the computed value falls continuously.<sup>5</sup> In contrast, Cheung et al. (2004), although they employ the same conventional total dependency ratio, apply a different criterion for assessing whether or not an economy is experiencing a demographic bonus—for them, the demographic bonus period corresponds to the stage where the computed value remains less than 0.5.<sup>6</sup> In addition, Golini (2004) defines the total dependency ratio in a slightly different manner—i.e.,  $[(\text{those aged } 0-14) + (\text{those aged } 60+)]/(\text{those aged } 15-59)$ —and classifies an economy as being at the demographic bonus stage when the calculated value is below 0.66.

<sup>5</sup>According to Komine and Kabe (2009), the demographic bonus is generated if the value of  $[(\text{those aged } 0-14) + (\text{those aged } 65+)]/(\text{those aged } 15-64)$  continuously declines with the passage of time.

<sup>6</sup>Cheung et al. (2004) assert that the demographic bonus is generated when the value of  $[(\text{those aged } 0-14) + (\text{those aged } 65+)]/(\text{those aged } 15-64)$  is less than 0.5.

Figure 5. The Period of Demographic Bonus Based on Three Different Approaches



Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

\*See the detail in the text.

Source: Authors' calculations based on data from United Nations. 2017. *World Population Prospects: The 2017 Revision*. New York.

A brief glance at Figure 5 reveals that the period of a demographic bonus differs considerably among the 12 selected Asian economies, depending upon the definitions utilized. In six out of the 12 economies, the period of a demographic bonus is not continuous if the computation is based upon the total dependency ratio formula. For instance, in the case of Japan, there is a 7-year hiatus (1970–1977) during the period 1950–1992. For the Lao PDR and Cambodia, the number of hiatuses is considerably greater than Japan and other selected Asian

economies: in the case of the Lao PDR, there are five (1966–67, 1972–1982, 1986, 1991–1993, and 1996) from 1965 to 2045; while Cambodia has four (1966, 1982–1987, 1989–1995, and 2017–2019) from 1965 to 2045.<sup>7</sup> Among the 12 economies, the Philippines would never enjoy a demographic bonus during the entire period from 1950 to 2050 if computations were made on the basis of the formula presented by Cheung et al. (2004). These calculated results imply that the timing and duration of the demographic bonus vary among the 12 economies. Moreover, the results for each economy also differ considerably, subject to the formulas used.

As briefly mentioned in the previous section, the conventional total dependency ratio and its variants assume the same weight for every person regardless of age, which is why they are very crude measures for quantifying the impact of age structural transformations on economic growth performance. To overcome this limitation of the total dependency ratio, we utilize the NTA system and calculate the “first demographic dividend” instead of the “demographic bonus.”

## B. A Brief Outline of the National Transfer Accounts

Since the beginning of the 21st century, an international collaborative research project has been carried out under the leadership of the following two economists: Andrew Mason at the University of Hawaii at Manoa and Ronald D. Lee at the Center for the Economics and Demography of Aging at the University of California, Berkeley. A number of collaborating institutions in Asia, Latin America, Europe, and Africa have been actively engaged in this international research project. At present, almost 100 economies, both developed and developing, constitute the full membership of the NTA global project.

One of the principal objectives of this project is to develop a system for measuring economic flows across age groups. These flows arise because, in any viable society, dependent members of the population—those who consume more than they produce—are supported by members of the population who produce more than they consume. Societies take different approaches to reallocating resources from surplus to deficit ages, but two methods dominate. One method relies on capital markets. Individuals accumulate capital during their working ages. When they are no longer productive, the elderly can support their consumption by relying on capital income (e.g., interest, dividends, rental income, and profits) and by liquidating their assets. The second method relies on transfers from those at surplus ages to those at deficit ages. Some transfers are mediated by the public sector. Important examples of these kinds of transfers are public education, publicly

<sup>7</sup>Presumably, the age compositional shifts in the Lao PDR and Cambodia were the consequence of the Indochina Wars (1946–1991), including the Viet Nam War (1955–1975).

financed health care, and public pension programs. Many transfers are private; among them, familial transfers are vital. The material needs of children are provided for mostly by their parents. In Asian societies, familial transfers between adult children and the elderly are also of huge significance. Some of these transfers are between households, but intrahousehold transfers are much more important.

NTA provide a comprehensive framework for estimating consumption, production, and resource reallocations by age. The accounts are constructed so as to be consistent with and complementary to the National Income and Product Accounts. Also, sectoral disaggregation allows the analysis of public and private education and health-care spending. The NTA system will provide important new information relevant to the following issues: (i) the first demographic dividend, (ii) the second demographic dividend, and (iii) intergenerational transfers (public and private [familial] transfers), (iv) aging policy, and (v) childbearing incentives.<sup>8</sup>

### C. Defining and Measuring the First Demographic Dividend

As discussed elsewhere (Mason 2001, 2007; Mason and Lee 2006; Lee and Mason 2011), one of the important linkages between demographic transformations and economic growth is the role of demographic dividends in the process of economic development. As a country proceeds through the stages of demographic transition, it undergoes considerable age structural shifts. When a country's fertility begins to fall, the first demographic dividend is generated because changes in its population age structure have led to an increase in the population at working ages relative to that at nonworking ages. In other words, the first demographic dividend arises because of an increase in the share of the population at ages during which production exceeds consumption. That is, the first demographic dividend is positive when the economic support ratio, which is defined as the ratio of effective workers to effective consumers, increases (Mason 2007).<sup>9</sup>

Using relatively simple mathematical notations, we can provide a short description of the measure for the first demographic dividend: income per effective consumer  $[Y(t)/N(t)]$ , which is a measure of per capita income adjusted for age variation in consumption, is the product of the economic support ratio  $[L(t)/N(t)]$  and income per worker  $[Y(t)/L(t)]$ :<sup>10</sup>

$$\frac{Y(t)}{N(t)} = \frac{L(t)}{N(t)} \times \frac{Y(t)}{L(t)} \quad (1)$$

<sup>8</sup>For further information on the NTA system, see the website of the Global NTA project at <http://www.ntaaccounts.org>.

<sup>9</sup>Effective workers are calculated as a weighted sum of the population using the labor income age profile. Effective consumers are calculated in a similar fashion, using the consumption age profile.

<sup>10</sup>For a more detailed mathematical description, see Mason (2007).

Furthermore,  $N(t)$ , which represents the effective number of consumers, and  $L(t)$ , which represents the effective number of workers, can be expressed as below:

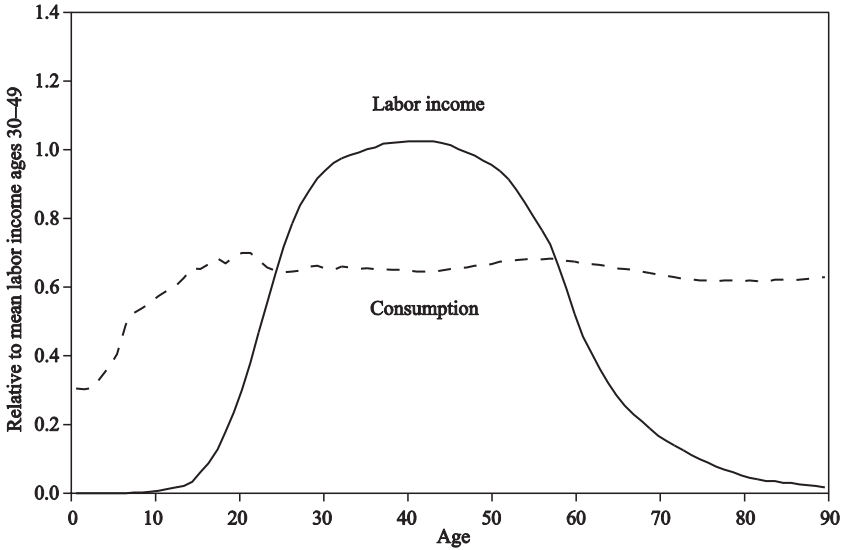
$$\begin{aligned} N(t) &= \sum_a \alpha(a)P(a, t) \\ L(t) &= \sum_a \beta(a)P(a, t) \end{aligned} \quad (2)$$

where  $a$  and  $t$  denote age and year, respectively;  $\alpha(a)$  and  $\beta(a)$  are the age profiles of consumption and production respectively; and  $P(a, t)$  is the population. Hence, the estimates of the first demographic dividend are heavily dependent upon the average age profiles of consumption (with both private and public sectors combined) and production (for both paid employment and self-employment) of the economy under study.

By the time of writing this paper, we managed to obtain the data required for computing the first demographic dividend from the following 12 NTA member economies in Asia: Cambodia in 2009; the PRC in 2009; Indonesia in 2012; India in 2004; Japan in 2014; the Lao PDR in 2012; Malaysia in 2009; the Philippines in 2015; the Republic of Korea in 2015; Thailand in 2013; Taipei, China in 2015; and Viet Nam in 2012. By combining the age-specific per capita consumption and production data for these 12 economies, weighted by the age-specific population size for each economy, we have created the age-specific per capita consumption and production profiles for “Asia as a whole” as an approximation (Figure 6). In addition, the age-specific profiles of consumption and production on a per capita basis for each of these 12 economies are displayed for comparative purposes in Figure 7. These graphical expositions of the vertical values for both consumption and labor income have been normalized on the basis of mean labor income for those aged 30–49 years with a view to facilitating intereconomy comparative analyses.

It can be seen from Figures 6 and 7 that the two crossing ages at which the status of economic independence changes differ substantially from graph to graph. In the case of Asia as a whole, as shown in the top row of Table 2, the age at which net consumers become net producers is 24, whereas the age at which net producers become net consumers is 57. These two ages suggest that an average Asian earns labor income greater than consumption for 33 years. Furthermore, a quick glance at the ages of crossing from net consumers to net producers among the 12 Asian economies listed in Table 2 reveals that the PRC and Cambodia have the lowest age (21 years), followed by Viet Nam (22 years), the Lao PDR (23 years), and the Philippines (23 years old), while Japan and the Republic of Korea have the highest age (28 years), followed by India (26 years) and Indonesia (26 years). For the crossing ages from net producers to net consumers, Cambodia has the lowest age (47 years), followed by Viet Nam (53 years). In contrast, the Lao PDR has the highest age (62 years). Among the 12 economies, the difference between these two

Figure 6. A Typical Asian Economic Life Cycle: NTA Estimates of Per Capita Consumption and Labor Income for Asia as a Whole



NTA = National Transfer Accounts.  
 Source: Authors' calculations based on the National Transfer Account database.

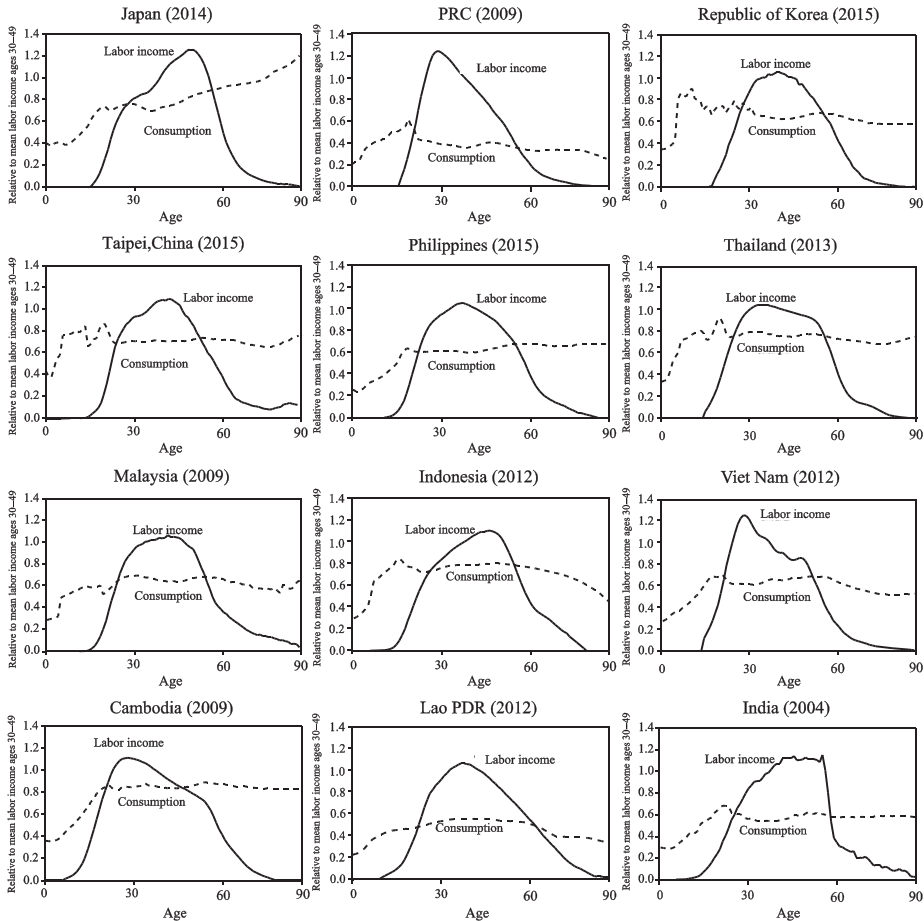
ages is the largest in the case of the Lao PDR; an average Laotian produces more than his or her consumption for 39 years. Interestingly, the Lao PDR's neighbor, Cambodia, has the shortest duration, i.e., 26 years. Obviously, this intereconomy disparity in the crossing ages generates differences in the length and magnitude of the first demographic dividend to a considerable extent.

To quantitatively demonstrate the timing and duration of the first demographic dividend for each economy, we need to discuss intertemporal changes in the economic support ratio. Equation (1) can be expressed in growth terms as follows:

$$g\left(\frac{Y(t)}{N(t)}\right) = g\left(\frac{L(t)}{N(t)}\right) \times g\left(\frac{Y(t)}{L(t)}\right) \tag{3}$$

The first demographic dividend is the rate of growth of the economic support ratio, which rises or falls subject to the age compositional transformations in the process of the demographic transition. During the demographic transition when the economic support ratio is rising, income per effective consumer increases, given that there is no change in productivity. As the economic support ratio declines, however, income per effective consumer falls and the first demographic dividend disappears. Thus, it should be stressed that the increase in income per effective consumer is transitory. More importantly, the first demographic dividend

Figure 7. Comparison of Economic Life Cycle Patterns in the 12 Selected Asian Economies



Lao PDR = Lao People’s Democratic Republic, PRC = People’s Republic of China.  
 Source: Authors’ calculations based on the National Transfer Account database.

can be realized only if employment keeps pace with the growth of the working-age population.

Now, we shall discuss the computed results pertaining to the first demographic dividend for Asia as a whole and then for the 12 selected Asian economies individually. With a view to quantifying the first demographic dividend for Asia as a whole, which is approximated by combining the data compiled from the 12 selected Asian economies, we have calculated the change in the economic support ratio over the period 1950–2050, by applying the computed age-specific per capita consumption and production results displayed in Figure 6 as statistical weights to the projected age-specific population of the entire Asia. At



Table 2. **Crossing Age at Which the Status of Economic Independence Changes for Asia as a Whole and for 12 Selected Asian Economies**

Economy	Crossing Age	
	From Net Consumers to Net Producers	From Net Producers to Net Consumers
Asia as a whole	24	57
India	26	59
Philippines	23	57
Thailand	25	56
Indonesia	26	56
People's Republic of China	21	58
Republic of Korea	28	57
Taipei, China	25	55
Cambodia	21	47
Malaysia	25	56
Viet Nam	22	53
Lao PDR	23	62
Japan	28	59

Lao PDR = Lao People's Democratic Republic.

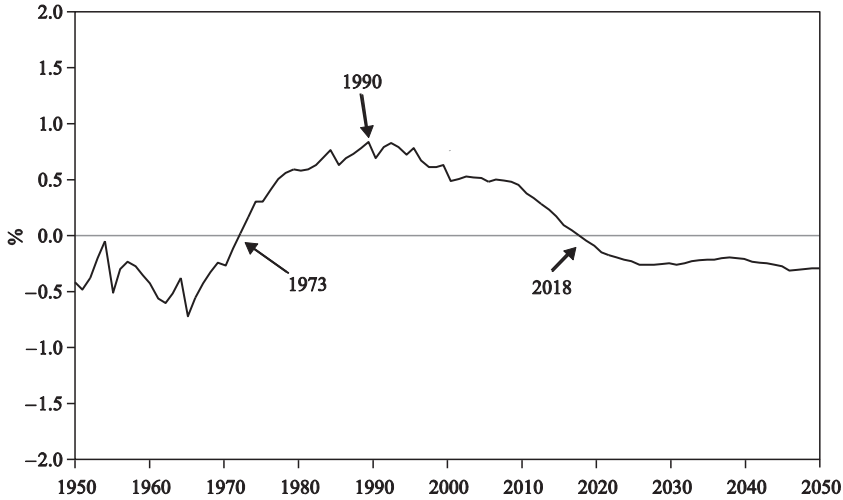
Source: Authors' calculations based on the National Transfer Account database.

this point, we have applied the same age-specific profiles of per capita consumption and production, plotted in Figure 6, to the age-specific population of the whole continent, assuming that these profiles remain unchanged throughout the entire 100-year period under review. This implies that the computational results only reflect the effect of age structural change on the economic support ratio. In addition, we have used the 2017 UN population projection as a source of demographic data for computation.

The computed results of the first demographic dividend for Asia as a whole, which is measured by the annual growth rate of its economic support ratio, are shown in Figure 8. In case the annual growth rate of the economic support ratio is positive, the first demographic dividend is generated. As can be observed in this graphical exposition, the first demographic dividend for the entire Asia began in 1973, and is projected to come to an end in 2018, after which the Asian region as a whole is expected to enter into the phase of population aging. Thus, the duration of the first demographic dividend for Asia as a whole amounts to 45 years. As indicated in Figure 8, the peak year of Asia's first demographic dividend was 1990.

Furthermore, by heavily drawing upon the per capita age-specific labor income and consumption data for each of the selected Asian economies, and on the basis of the same computational assumptions and procedure applied to the case of Asia as a whole, we have calculated a temporal change in the economic support ratio for each of the 12 selected Asian economies for comparative purposes. The calculated results are presented in Figure 9. There are marked intereconomy differences among the 12 economies, both in terms of the timing and the duration

Figure 8. **Temporal Change in the Magnitude of the First Demographic Dividend for Asia as a Whole, 1950–2050**

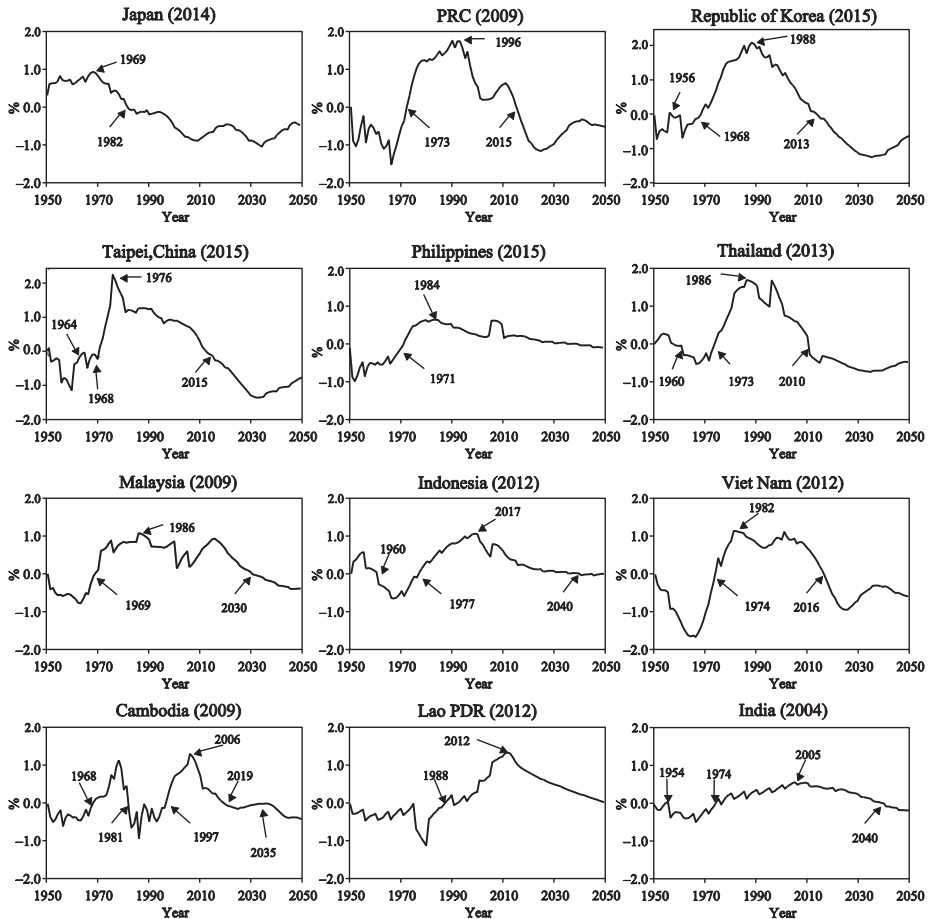


Source: Authors' calculations based on the National Transfer Account database.

of the first demographic dividend. A few points of interest emerge from the results shown in Figure 9. First, Japan entered the phase of the first demographic dividend in 1950, which was the earliest among the 12 selected Asian economies in the sample, and was followed by the Republic of Korea and Taipei, China in 1968. Japan's first demographic dividend period ended in 1982, while the corresponding periods for the Republic of Korea and Taipei, China came to an end in 2013 and 2015, respectively. Second, among the 12 economies, Japan had the shortest duration of the first demographic dividend, i.e., 32 years. Cambodia has the second shortest duration of the first demographic dividend, i.e., 37 years from 1968 to 1981 and from 1997 to 2019. However, Cambodia is an exceptional case among the 12 economies in that its first demographic dividend period is broken into two subperiods. As mentioned earlier, this hiatus between 1981 and 1997 was affected substantially by the unusual age compositional shift caused by a series of wars in which Cambodia was involved in the second half of the 20th century. Third, among the 12 selected Asian economies, the Philippines is projected to have the longest period of the first demographic dividend at 79 years from 1971 to 2050. The Philippines is followed by Indonesia, the Lao PDR, and India, which are projected to have first demographic dividends lasting 63, 64, and 66 years, respectively.

More importantly, a quick glance at Figure 9 reveals that the annual growth rate of the economic support ratio differs considerably across economies and with the passage of time, thus indicating that the magnitude of the first demographic dividend varies substantially among the 12 economies and over time. To shed light upon the magnitude of the first demographic dividend for each economy, we have

Figure 9. Comparison of the Temporal Change in the Magnitude of the First Demographic Dividend in 12 Selected Asian Economies



Lao PDR = Lao People’s Democratic Republic, PRC = People’s Republic of China.  
 Source: Authors’ calculations based on the National Transfer Account database.

computed the average annual growth rate of the economic support ratio observed for each of the selected Asian economies between the beginning year and the end year of the first demographic dividend stage. As presented in Table 3, the largest magnitude was recorded by the Republic of Korea (1.13%), followed by Thailand (1.03%); Taipei, China (0.99%); and the PRC (0.90%).<sup>11</sup> In the case of the Philippines, the magnitude is expected to amount to a low value of 0.34%. India is projected to have an even lower value of 0.31%.

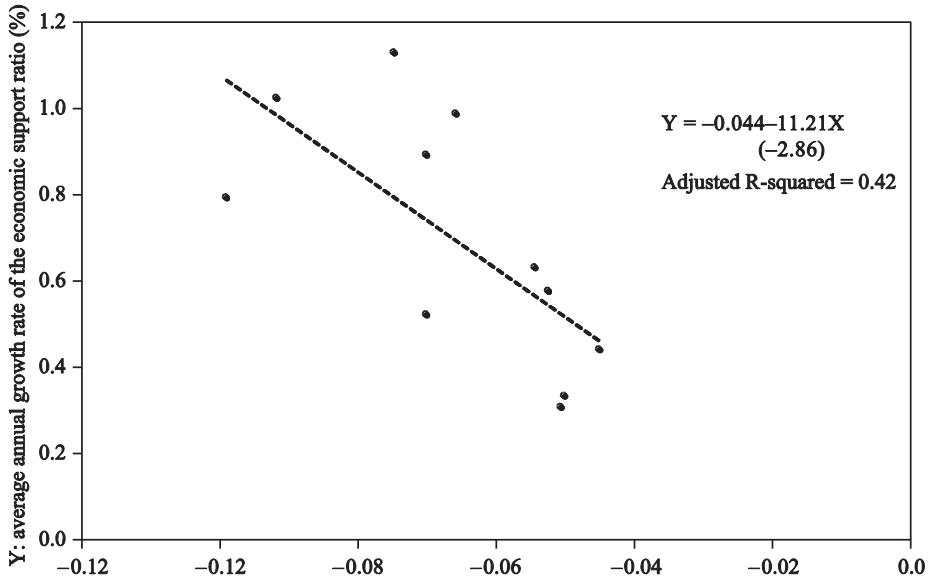
<sup>11</sup>As previously mentioned, due to the unusual temporal change of its first demographic dividend, Cambodia has been excluded from this computation.

Table 3. Timing and Duration of the First Demographic Dividend and Amount of Fertility Decline over the First Demographic Dividend Period in 11 Selected Asian Economies

Economy	First Demographic Dividend				Total Fertility Rate			
	Beginning Year	Ending Year	Duration (years)	Average Annual Growth Rate of the Economic Support Ratio	Year in Which Demographic Dividend Commences	Year in Which Demographic Dividend Ends	Difference between the Two Years	Average Amount of Reduction of the Total Fertility Rate per Year
Japan	1950	1982	32	0.58	3.44	1.76	-1.69	-0.05
PRC	1973	2015	42	0.90	4.57	1.62	-2.95	-0.07
Republic of Korea	1968	2013	45	1.13	4.62	1.24	-3.38	-0.08
Taipei, China	1968	2015	47	0.99	4.26	1.16	-3.10	-0.07
Philippines	1971	2050	79	0.34	6.15	2.17	-3.98	-0.05
Thailand	1973	2010	37	1.03	4.95	1.55	-3.41	-0.09
Malaysia	1969	2030	61	0.63	5.17	1.84	-3.33	-0.05
Indonesia	1977	2040	63	0.44	4.81	1.96	-2.85	-0.05
Viet Nam	1974	2016	42	0.80	6.13	1.95	-4.17	-0.10
Lao PDR	1988	2052	64	0.52	6.27	1.77	-4.50	-0.07
India	1974	2040	66	0.31	5.28	1.93	-3.35	-0.05

Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.  
 Source: Authors' calculations based on data from United Nations, 2017. *World Population Prospects: The 2017 Revision*. New York.

Figure 10. **Estimated Relationship between the Magnitude of the First Demographic Dividend and Amount of Reduction in the Total Fertility Rate per Year in Selected Asian Economies**



Note: X refers to the average reduction in the total fertility rate per year.

Source: Authors' calculations based on data from United Nations, 2017. *World Population Prospects: The 2017 Revision*. New York.

Besides the average annual growth rate of the economic support ratio for the selected Asian economies, we have also gathered data, as indicated in Table 3, pertaining to the average annual amount of the decline of the TFR from the beginning year to the final year of the first demographic dividend. To gain further insights into the relationship between the magnitude of the decline of the TFR and the average annual growth rate of the economic support ratio during the first demographic dividend stage, we have conducted a relatively simple regression analysis, covering all 11 economies listed in Table 3. In the regression equation, the former variable has been employed as the explanatory variable and the latter as the dependent variable. As shown in Figure 10, the estimated coefficient for the explanatory variable is statistically significant ( $t$ -value of  $-2.86$ ), suggesting that the greater the average amount of fertility reduction per year, the greater the potential impact of the first demographic dividend on macroeconomic growth. This statistical result is in agreement with an axiomatic view held among population economists that one of the key factors conducive to Asia's miraculous economic growth in the past several decades has been its extremely rapid decline in the TFR (Bloom, Canning, and Malaney 2000; Lee and Mason 2011; Mason and Lee 2012).

#### D. Computing the Second Demographic Dividend

The second demographic dividend corresponds to the growth rate of productivity or output per effective worker, which is induced by the accumulation of wealth as well as physical and human capital deepening. The second demographic dividend arises when individuals at all age groups increase their demand for wealth in some form to support their old-age consumption. One possibility is that old-age economic security might heavily rely on transfers from public pension and welfare programs, or from adult children and other family members. The other possibility is that individuals accumulate capital during their working years, which in turn serves as the source of support in retirement. Both of these forms of wealth can be utilized to support consumption in old age.

It is extremely important to pay attention to the following key point: only capital accumulation will lead to an increase in productivity. Unlike the first demographic dividend, the second demographic dividend is not transitory, and it may lead to a permanent increase in capital deepening and income per effective consumer. The second demographic dividend does not occur automatically, but rather can be realized if consumers and policy makers are forward looking and respond effectively to coming demographic changes by encouraging an old-age support system that substitutes capital for the transfer of wealth. There are two ways that demographic factors cause an increase in the demand for life cycle wealth and the second demographic dividend. First, there is a compositional effect, caused by an increase in the share of individuals who have nearly or fully completed their productive years. Second, there is a behavioral effect, caused by an increase in life expectancy and the accompanying increase in the duration of retirement leading to an increase in demand for wealth.

Demand for life cycle wealth is mainly concentrated among older working adults who are approaching their peak earnings and have completed their childrearing responsibilities. Mason (2007) uses the wealth held by those aged 50 years and older to measure the effect of demography on life cycle wealth and the second demographic dividend. Demand for life cycle wealth is computed as the difference between the present value of lifetime consumption and the present value of lifetime production for adults.<sup>12</sup>

By closely following the computational procedure described in Mason (2007), we have calculated the second demographic dividend for all 12 economies listed in Figure 7. All the values reported in Table 4 represent the average annual

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<sup>12</sup>Computational assumptions employed in Mason (2007) were as follows: (i) holding the transfer policy constant so that the growth rates of the capital and life cycle wealth are equal; (ii) setting the elasticity of labor income with respect to capital at 0.5 (i.e., the second demographic dividend is calculated as half of the growth rate of wealth ratio to income); and (iii) the growth of consumption and labor income are 1.5% per year, and the interest rate is 3%.

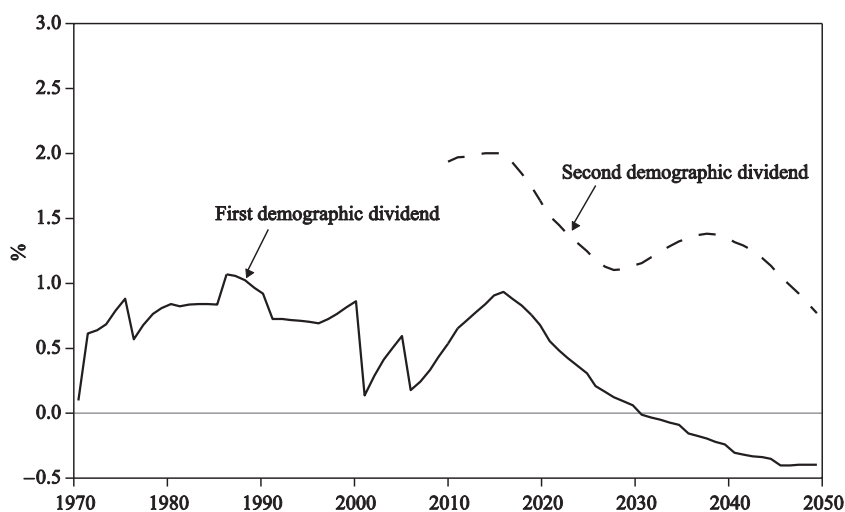
Table 4. **Second Demographic Dividend in 12 Selected Asian Economies Expressed in Terms of the Annual Growth Rate (%)**

Economy	Profile	2010–2020	2020–2030	2030–2040	2040–2050
Japan	2014	0.29	0.32	0.18	0.01
Republic of Korea	2015	2.01	1.09	0.37	0.13
Malaysia	2009	1.91	1.29	1.29	1.10
Philippines	2015	1.27	1.22	0.97	0.80
Thailand	2013	1.77	1.23	0.50	0.20
Viet Nam	2012	1.75	1.07	0.98	0.62
Lao PDR	2012	6.25	2.89	2.24	1.88
Taipei, China	2015	1.79	0.86	0.34	0.13
PRC	2009	1.79	0.99	0.64	0.42
Cambodia	2009	1.48	0.73	1.65	1.17
India	2004	1.43	1.17	1.08	0.90
Indonesia	2012	1.97	1.63	1.18	0.78

Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Source: Authors' calculations based on the National Transfer Account database.

Figure 11. **Comparison of the First and Second Demographic Dividends in Malaysia**



Sources: Authors' calculations based on the National Transfer Account database.

growth rate of capital stock for each successive decade over the period 2010–2050. As can be clearly seen from this table, most of the developing Asian economies are likely to have a sizable second demographic dividend in the years to come. Particularly, the magnitude of the second demographic dividend is substantially larger than that of the first demographic dividend over the period 2010–2050 in all economies. To illustrate this point more concretely, we have plotted in Figure 11 the pattern of changes in the first and second demographic dividends

for Malaysia. It is also worth observing that although Japan's first demographic dividend has already been negative for more than 3 decades, as shown in Figure 8, its second demographic dividend, which is projected to occur substantially after the 2020–2030 period, is expected to remain positive up to 2050.

Before closing our discussion pertaining to the first and second demographic dividends, we should bear in mind that the projected results summarized in Tables 3 and 4 reflect only the age compositional effect. The relationship between the demographic dividends and income growth is very policy dependent. The first demographic dividend arises in part because the working-age population is growing rapidly. The economic gains can be realized only if employment opportunities expand as rapidly as the numbers seeking new jobs. The second demographic dividend arises in part because prime-age adults save more to provide for their retirement. Their ability or willingness to save, however, may be undermined by poorly developed financial markets or overly generous publicly funded pension programs. Demographic transformations simply define possibilities, and the outcome is heavily dependent on a large number of nondemographic factors.

#### IV. Population Aging and Its Impact on Intergenerational Transfers in Three East Asian Economies

In this section, we use the NTA system to analyze the changing patterns of intergenerational transfers in Japan; the Republic of Korea; and Taipei, China. These three East Asian economies have already entered an advanced stage of population aging, where the patterns of intergenerational transfers, both public and private (familial), have been shifting to a marked extent. For the sake of convenience, we first examine the NTA computational results for Japan, the forerunner of Asia's population aging. Subsequently, we compare the case of Japan with those of the Republic of Korea and Taipei, China.

The NTA, which measures intergenerational flows for a certain period of time, is governed by the following relationship:

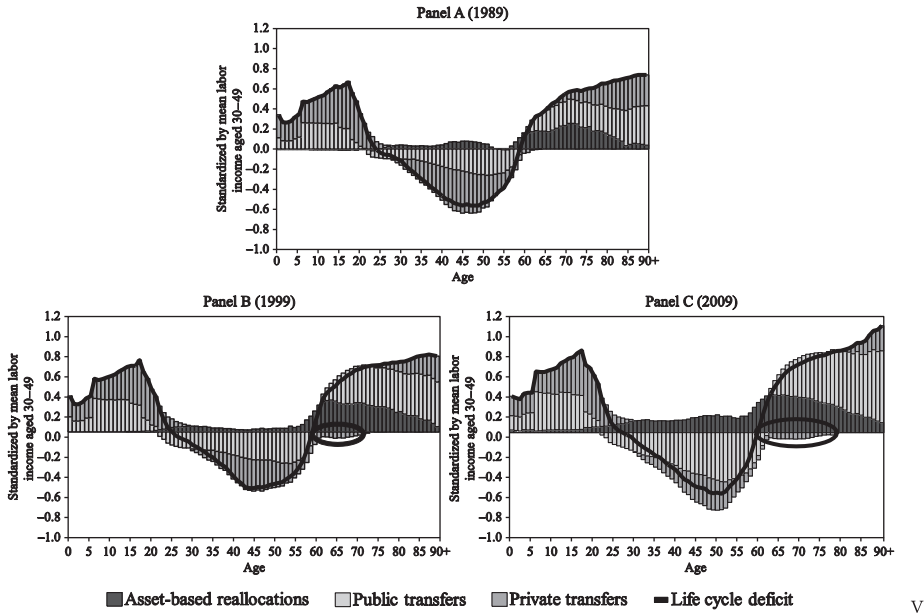
$$y^l + r(K + M) + \tau_g^+ + \tau_f^+ = C + I_K + I_M + \tau_g^- + \tau_f^- \quad (4)$$

where  $y^l$  = labor income;  $rK$  = returns to capital;  $rM$  = returns to land and credit;  $\tau_g^+$  = transfer inflows from the public sector;  $\tau_f^+$  = transfer inflows from the private sector;  $C$  = consumption;  $I_K$  = investment in capital;  $I_M$  = investment in credit and land;  $\tau_g^-$  = transfer outflows to the government; and  $\tau_f^-$  = transfer outflows to the private sector.

In addition, the life cycle deficit, which is the difference between consumption and production, is matched by age reallocations consisting of reallocations through assets and net transfers as expressed below:



Figure 12. **Changing Pattern of the Per Capita Life Cycle Deficit in Japan**



Source: Authors' calculations based on the National Transfer Account database.

$$\underbrace{C - y^l}_{\text{Lifecyle deficit}} = \underbrace{y^A - S}_{\text{Asset reallocations}} + \underbrace{\tau_g^+ - \tau_g^-}_{\text{Net public transfers}} + \underbrace{\tau_f^+ - \tau_f^-}_{\text{Net private transfers}} \tag{5}$$

}
Net transfers

}
Age reallocations

where  $y^A$  = asset income, and  $S$  = saving.

Before proceeding to a discussion of the computational results, however, caution should be exercised with regard to the following two points. First, the terms “familial transfers” and “private transfers” are used interchangeably in this paper—both refer to transfers coming from other family members of the same or a different household. Second, although net private transfers comprise bequests and inter vivos transfers, the computation of the bequest component had not been completed at the time of writing this paper. For this reason, bequests are excluded from the computational results reported in this paper. Also, the estimated values for the totals have been adjusted on the basis of National Income and Product Account values to ensure consistency.

Figure 12 compares the changing patterns of the three components of reallocation of the life cycle deficit for the entire population in Japan from 1989 to 2009. The three components include net reallocations through assets, net public

transfers, and net private (familial) transfers. Panels A, B, and C illustrate the annual reallocations of the per capita life cycle deficit for the whole population of Japan observed in 1989, 1999, and 2009, respectively.

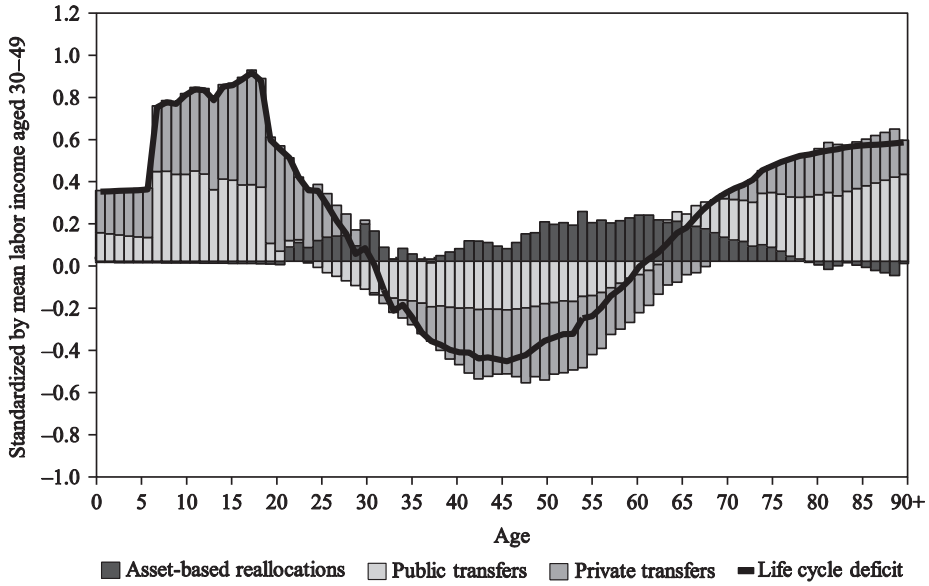
A brief comparison of the three panels in Figure 12 reveals the following two points of interest. First, the composition of net transfers to the elderly population changed dramatically over the 20-year period from 1989 to 2009. To facilitate the intereconomy comparison among the three East Asian economies, we have standardized all the monetary values in the three panels by dividing them by the mean labor income of those aged 30–49 years. As can be easily observed by comparing the three panels, the amount of per capita net public transfers to the elderly population increased significantly from 1989 to 2009. Similarly, the amount of net asset-based reallocations grew remarkably over the same period. In contrast, the relative importance of net private (familial) transfers from the young to the elderly declined to an appreciable extent. These results seem to indicate that the Japanese elderly have been increasingly dependent upon public transfers (predominantly old-age pensions and medical care services) and asset-based reallocations in supporting their retirement life.

Second, and more important, as marked by the two ovals in Figure 12 (one in Panel B and the other in Panel C), the amount of net private (familial) transfers to the relatively young elderly persons (roughly in their 60s and early 70s) was negative in both 1999 and 2009, implying that the amount of financial assistance the relatively young elderly persons provided to their adult children and/or grandchildren exceeded the monetary assistance from the latter to the former. From Panels A and B, we see that the amount of such negative net familial transfers from the relatively young elderly to other age groups rose during the period of Japan's "lost decade" (Yoshikawa 2001). These results suggest that despite the fact that multigenerational coresidence has weakened over the past few decades (Ogawa, Retherford, and Matsukura 2006), the Japanese elderly still play a vital role in providing financial support to their offspring when the latter encounter economic difficulties.<sup>13</sup>

Next, by utilizing calculated results for Japan presented in Panel C of Figure 12, we compare Japan's intergenerational transfer pattern with that of the Republic of Korea in 2015 (Figure 13) and Taipei, China in 2015 (Figure 14). A close examination of these three graphical expositions reveals that in the case of Japan, public transfers play a more dominant role in financing the life cycle deficit among the elderly population than in the cases of the Republic of Korea and Taipei, China. This intereconomy difference is largely attributable to the fact that, because the social security system in Japan was established approximately 3 decades earlier

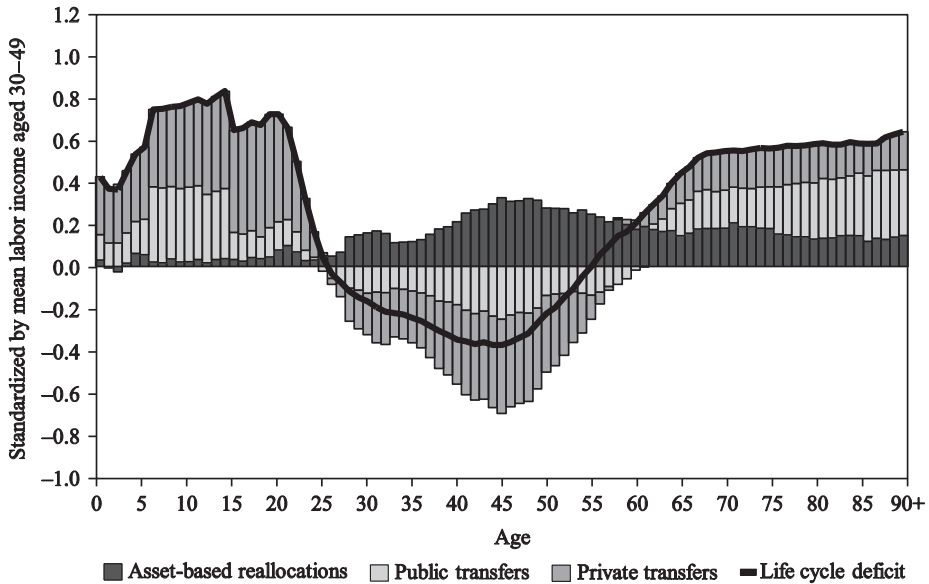
<sup>13</sup>Although older persons in Japan are often considered an overall liability for the country, they are actually playing a key role as society's safety net. For this reason, they should be viewed as latent assets in contemporary Japanese society (Ogawa 2008; Ogawa, Matsukura, and Chawla 2011).

Figure 13. Pattern of the Per Capita Life Cycle Deficit in the Republic of Korea, 2015



Source: Authors' calculations based on the National Transfer Account database.

Figure 14. Pattern of the Per Capita Life Cycle Deficit in Taipei,China, 2015



Source: Authors' calculations based on the National Transfer Account database.

than in the Republic of Korea and Taipei, China, Japanese elderly persons have been able to enjoy higher pension benefits at a more mature stage, as well as more comprehensive medical care services than their counterparts in the Republic of Korea and Taipei, China. Moreover, in the Japanese case, the net asset reallocations play a more substantial role in financing the life cycle deficit among the elderly population than in the case of either the Republic of Korea or Taipei, China. This difference reflects the fact that the three economies underwent rapid economic growth at considerably different points in time.

In view of future aging trends in both the Republic of Korea and Taipei, China, it is highly conceivable that the two economies will follow in Japan's recent footsteps in transforming their patterns of intergenerational transfers by shifting to public transfers and asset reallocations, and attaching less importance to private (familial) transfers, particularly among the elderly population. Furthermore, although the current demographic setting of these three East Asian economies is considerably more advanced than that of most developing economies in South and Southeast Asia, many of the economies in the three Asian subregions share to a great extent similar traditional values relating to familial responsibilities. In view of these similarities, we may safely presume that the recent experiences of the changes in intergenerational transfers in the abovementioned East Asian economies can serve as a useful regional reference point to many developing economies in Asia for formulating effective and efficient policies for coping with rapid population aging.

It is also worth observing that the private (familial) transfers directed to the young population in the three East Asian economies are noticeably larger than those in NTA economies outside Asia, although relevant graphs for interregional comparison are omitted. As discussed elsewhere (Ogawa et al. 2015), the amount of financial resources that parents spend on their children's education is extremely large in these three East Asian economies, and this has been one of the major reasons why East Asia currently has the lowest TFR in the world.

## V. The Potential Work Capacity of the Elderly and the “Silver Demographic Dividend”

In this section, we turn our attention from the NTA-based analysis to a new analytical topic—a newly defined demographic dividend generated through the use of the untapped work capacity of healthy older persons. In this study, we label it “the silver demographic dividend.” For the sake of convenience, we may also refer to it as “the third demographic dividend” to distinguish it from the two demographic dividends directly computed from the NTA system.

Our main motive to shed light on measuring this newly defined demographic dividend is related to the recent shortage of human resources in some of Asia's aging

economies. Japan is a typical case; its labor force size and its age composition have changed significantly in the postwar period. According to Japanese census data, the size of the total labor force grew continuously from 1970 to 1995. After reaching its peak in 1995, however, it commenced shrinking. According to the population projection released in 2019 by the National Institute of Population Problems and Social Security Research, the working-age population (15–64 years old) is expected to dwindle from 77.3 million in 2015 to 45.3 million in 2065. Taking into consideration such gloomy demographic and labor force prospects, the Government of Japan recently announced an eye-catching plan. According to it, the government will require all employers to keep their employees on the payroll until they reach the age of 70 if the latter wish to stay on. To achieve this goal, the government is asking businesses to choose from among seven measures designed to allow older people to continue working. The measures include abolishing the retirement age, extending the retirement age to 70, and introducing elderly employees to jobs at other firms. Furthermore, the legislation is expected to come in two stages. First, the government plans to submit a bill, urging businesses to keep their employees until they reach the age of 70. After that, the government will eventually make the above measures mandatory.

In view of this recent government initiative, we have attempted to measure the potential work capacity of old workers to alleviate the adverse effects of aging and population decline on Japan's economic growth. To facilitate this numerical exercise by following up on our earlier study (Matsukura et al. 2018), we have attempted to quantify the potential work capacity in Japan in terms of health status among those aged 50 and over, by pooling all the observations from the first to the fifth waves (i.e., 2007, 2009, 2011, 2013, and 2015) of the survey called the Japanese Study of Aging and Retirement (JSTAR).<sup>14</sup> In our earlier work (Matsukura et al. 2018), we covered only the first three waves of JSTAR. In the present study, we first estimate the relationship between health and employment for men and women aged 50–59 and use the estimated result, along with the actual characteristics of old people (aged 60–79), to simulate the latter's capacity to work based on their health. We then attempt to link the estimated statistical results derived from JSTAR to the system of NTA to quantify to what extent the economic support ratio would be enhanced through utilization of the untapped work capacity among old workers (aged 60–79).

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<sup>14</sup>JSTAR is a longitudinal, interdisciplinary survey that collects internationally comparable data on the middle aged and old. The JSTAR project commenced in 2007, and the survey has been implemented in 2-year intervals. JSTAR is a sister survey compatible with the Health and Retirement Study; English Longitudinal Study of Aging; Survey of Health, Aging, and Retirement in Europe; China Health and Retirement Longitudinal Study; and Longitudinal Aging Study in India. JSTAR's design and sample methodology are described elsewhere (Ichimura, Hashimoto, and Shimizutani 2009). The baseline sample consists of male and female respondents aged 50–75 from 10 municipalities. The respondents were randomly chosen from household registries kept by the local governments. The sample size and the average response rate at the baseline were approximately 8,000 and 60%, respectively. JSTAR collects a wide range of variables, including the economic, social, family, and health conditions of the sampled respondents.

In our analysis, we have not included a number of factors affecting the decision of labor supply (e.g., wages), but focused on the health disability to examine to what extent the labor supply of the elderly is limited. We have employed a linear probability model to regress the binary variable of employment, which is equal to 1 if the individual is in the labor force (both employed and unemployed) and 0 if the individual is out of the labor force, on the following health-related explanatory variables: (i) dummy variables for self-reported health status (five-point scale); (ii) the incidence of limitations on instrumental activities of daily living; (iii) the Center for Epidemiologic Studies Depression Scale;<sup>15</sup> (iv) the Nagi physical ability index;<sup>16</sup> (v) limitations in sensory organs (eyesight, hearing, and chewing);<sup>17</sup> and (vi) individual attributes such as sex, educational attainment, and marital status. In addition, dummy variables for each municipality and for survey years have been included.

The estimated regression results are summarized in Table 5. By utilizing these results, we have simulated the untapped work capacity for Japanese older adults aged 60–79. We have used the estimated coefficient to compute predicted values for each individual in JSTAR and averaged them by each age. The “untapped work capacity” is defined as a slack between the actual and the predicted employment probability. Figure 15 shows that the estimated untapped work capacity, marked in gray, increases with age. The untapped work capacity in Japan is estimated to amount to 4.12 million for persons aged 60–79.

To calculate the potential impact of these additional workers on Japan’s gross domestic product (GDP), we have set up the following three cases. Case I assumes that if the potential elderly workers are employed, they earn labor income in accordance with the NTA age-specific labor income profile observed in 2009; Case II assumes that the potential elderly workers at each age can earn the same amount of labor income as their counterparts who were employed in 2014; and Case III assumes that if the potential elderly workers are employed, they earn only the minimum wage set by Japanese law. The computed results are as follows: in Case I, the real GDP for 2015 is 4.5% higher; in Case II, it is 6% higher; and in Case III, it is 3.2% higher. These additional GDP gains might be regarded as the “silver demographic dividend” or “third demographic dividend.”

<sup>15</sup>Scores on the Center for Epidemiologic Studies Depression Scale range from 0 to 60, where higher scores suggest a greater presence of depression symptoms. A score of 16 or higher is interpreted as indicating a risk for depression.

<sup>16</sup>The Nagi index in JSTAR consists of 10 items and is designed to capture difficulties in physical activities that are relevant to work capacity: (i) walking 100 meters, (ii) sitting continuously for 2 hours, (iii) standing up from a chair after sitting for a long time, (iv) climbing several steps without using the handrail, (v) climbing one step without using the handrail, (vi) squatting or kneeling, (vii) raising hands above the shoulders, (viii) pushing and pulling large objects such as chairs and sofas in a living room, (ix) lifting and carrying an object weighing more than 5 kilograms, and (x) grasping a small object such as a 1 yen coin with fingers.

<sup>17</sup>For each of the sensory organs, we have assigned the following three numerical values: 2 denotes conditions ranging from “very good” to “not bad,” 1 stands for “bad,” while 0 stands for “impossible.”

Table 5. Estimated Regression Results (Dependent variable: 1 = in the labor force, 0 otherwise)

Explanatory Variables	Coefficient	T-value	Explanatory Variables	Coefficient	T-value
Sex			Sensory organs		
Man	0.234	21.7***	Eyesight	-0.005	-0.16
Woman <sup>†</sup>	—	—	Hearing	-0.059	-1.48
Education			Chewing ability	0.136	3.53***
Junior high <sup>†</sup>	—	—	Municipalities		
Senior high	0.037	2.17**	Takikawa	0.016	0.56
Junior college	0.040	2.09**	Sendai	-0.043	-1.83*
University or higher	0.072	3.72***	Adachi	0.044	1.84*
Marital status			Chofu	0.031	1.15
Currently married	-0.079	-5.91***	Kanazawa	0.025	1.13
Currently not married <sup>†</sup>	—	—	Shirakawa	0.065	2.84***
Self-rated health status			Tondabayashi	0.019	0.76
Excellent	0.104	5.24***	Hiroshima <sup>†</sup>	—	—
Very good	0.060	3.06**	Tosu	0.016	0.67
Good	0.005	3.45**	Naha	0.017	0.75
Fair <sup>†</sup>	—	—	Year of survey		
Poor	-0.247	-5.52***	2007 <sup>†</sup>	—	—
CESD			2009	-0.025	-1.68*
≥16	0.019	1.55	2011	-0.028	-1.68*
<16 <sup>†</sup>	—	—	2013	-0.036	-1.87*
IADL			2015	-0.023	-0.91
≥1	0.005	0.45	Constant	0.577	4.44***
0 <sup>†</sup>	—	—			
Nagi index					
Walking 100 meters	-0.095	-1.51			
Sitting for two hours	-0.079	-1.75*			
Standing up for a long time	0.010	0.25			
Climbing several steps without the handrail	-0.060	-1.35			
Climbing one step without the handrail	-0.016	-0.29			
Squatting or kneeling	-0.038	-1.12			
Raising hands above the shoulders	-0.013	-0.24			
Pushing and pulling a large object	-0.074	-1.42			
Lifting and carrying more than 5 kilograms	-0.144	-2.75**			
Picking up a small object with fingers	0.150	2.06**			

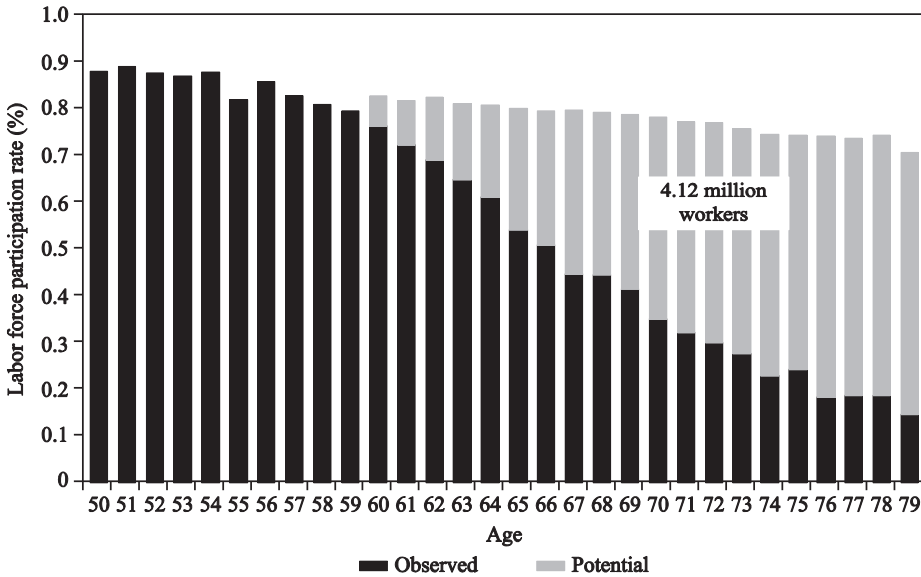
CESD = Center for Epidemiologic Studies Depression Scale, IADL = instrumental activities of daily living.

Notes: Adjusted R-squared = 0.165; number of observations = 4,666; and \*, \*\*, and \*\*\* represent statistical significance at the 10%, 5%, and 1% levels, respectively.

<sup>†</sup> Denotes the reference group.

Source: Authors' calculations.

Figure 15. Age-Specific Observed Labor Force Participation Rate and Potential Labor Force Participation Rate in Japan



Source: Authors' calculations.

In addition to Japan, we have applied a comparable analytical approach to Malaysia. In the case of Malaysia, we have drawn upon the data gathered from the 2011 National Health and Morbidity Survey conducted by the Institute of Public Health. The specification of regression is comparable to the Japanese case, although the number of explanatory variables introduced into the regression has been considerably smaller due to the limited compatibility of the information gathered by JSTAR and the National Health and Morbidity Survey. Table 6 presents each estimated regression coefficient together with the *t*-value.

The simulated results are interesting. If Malaysia's older adults aged 60 and over behaved in accordance with what the regression results suggest, the number of workers older than 60 in the country would be 2.14 times higher than what it is now. If such an increase in the number of older workers had been achieved, the country's GDP in 2011 would have increased between 0.55% (based upon Malaysia's NTA's age-specific labor income profile) and 0.95% (based upon minimum wages). These gains would also increase dramatically if we applied Japan's 2009 population structure to the Malaysian result; Malaysia's GDP would have increased by between 2.5% and 4.2%, which is fairly comparable to the results we obtained from the Japanese simulation.

The computational results for Japan and Malaysia suggest that the untapped labor capacity has enormous potential to boost the GDP of these two economies. However, we have not examined the issue of whether the use of untapped work



Table 6. Estimated Regression Results for Malaysia, 2011

Explanatory Variables		Coefficient	T-value
Constant		0.278	8.18***
Sex	Male	0.404	23.87***
	Female <sup>a</sup>	—	—
Ethnicity	Malay <sup>a</sup>	—	—
	Chinese	0.046	2.30**
	Indian	-0.013	-0.45
	Other <i>Bumiputeras</i>	0.006	0.19
	Others	0.126	2.68***
Education	No formal education <sup>a</sup>	—	—
	Primary education	0.040	1.33
	Secondary education	0.097	3.12***
	Tertiary education	0.228	5.84***
Marital status	Married <sup>a</sup>	—	—
	Single	0.049	1.17
	Widow, widower, divorcee	0.034	1.26
Self-rated health status	Good	0.041	2.05**
	Moderate <sup>a</sup>	—	—
	Bad	-0.119	-1.95*
Depression scale		0.007	1.40
Difficulty in work and daily activities		-0.023	-0.91
Eyesight		0.007	0.33

Notes: Adjusted R-squared = 0.193; number of observations = 3,114; and \*, \*\*, and \*\*\* represent statistical significance at the 10%, 5%, and 1% levels, respectively. “*Bumiputeras*” is a broad term that denotes Malays, the indigenous peoples of Malaysia known as Orang Asli, and the natives of Sabah and Sarawak in East Malaysia. “Other *Bumiputeras*” in the table above means *Bumiputeras* other than Malays.

<sup>a</sup>Denotes the reference group.

Source: Authors’ calculations.

capacity of old persons could affect the well-being of workers belonging to other age groups.

## VI. Concluding Remarks

In this paper, we have reviewed the trends in age structural shifts in a number of selected economies in Asia over the period 1950–2050 and analyzed their impact on the first and second demographic dividends, using the computed results generated under the global NTA project. The computed results indicate that although there has been and will be large variability in the level and tempo of population aging among Asian economies, the magnitude of the impact of the first and second demographic dividends on macroeconomic growth has been and will be substantial in most of them. More importantly, because the first demographic dividend is basically transitory in nature, each economy should be aware of its timing so as to seize its potential for strengthening the socioeconomic foundations for developing social security systems. Moreover, the impact of the second

demographic dividend on macroeconomic growth is subject to the effectiveness of a wide range of policies to be adopted by the government.

In addition, we have demonstrated, using the NTA framework, the impact of age structural shifts on the pattern of intergenerational transfers in Japan over the period 1989–2009 and subsequently compared the case of Japan in 2009 with the cases of the Republic of Korea and Taipei, China in 2015. The brief comparison suggests that, in view of the projected demographic trends, the Republic of Korea and Taipei, China will follow Japan in the shifting pattern of intergenerational transfers over the next few decades. Although our discussion has been confined primarily to these three economies, the empirical findings concerning them are highly applicable to other Asian economies for the following two reasons. First, many developing Asian economies have been following these East Asian economies in terms of their pattern of demographic development, and such a trend is likely to persist for many years to come, as seen in the 2017 UN population projection. Second, Japan, the Republic of Korea, and Taipei, China share traditional cultural values to a considerable degree and have a similar family organization. Moreover, there are many developing economies in Southeast and South Asia that have similar sociocultural and demographic traits to East Asia. In view of this, we may expect that the East Asian experiences of population aging and changing intergenerational flows will lend themselves to analyzing crucial policy issues likely to crop up in the future as part of the population aging process in developing economies in Southeast and South Asia.

Toward the end of this paper, we dealt with a new important research topic in the realm of population aging, “the silver demographic dividend” or “the third demographic dividend,” which is generated through the use of the untapped work capacity of healthy older adults. It is of great importance to note that this topic is closely related with changes in the health of the elderly. Since it is certain that the health of Asia’s elderly will continue improving over time, this new research topic is likely to be addressed by more population economists in Asia and elsewhere in the future.

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